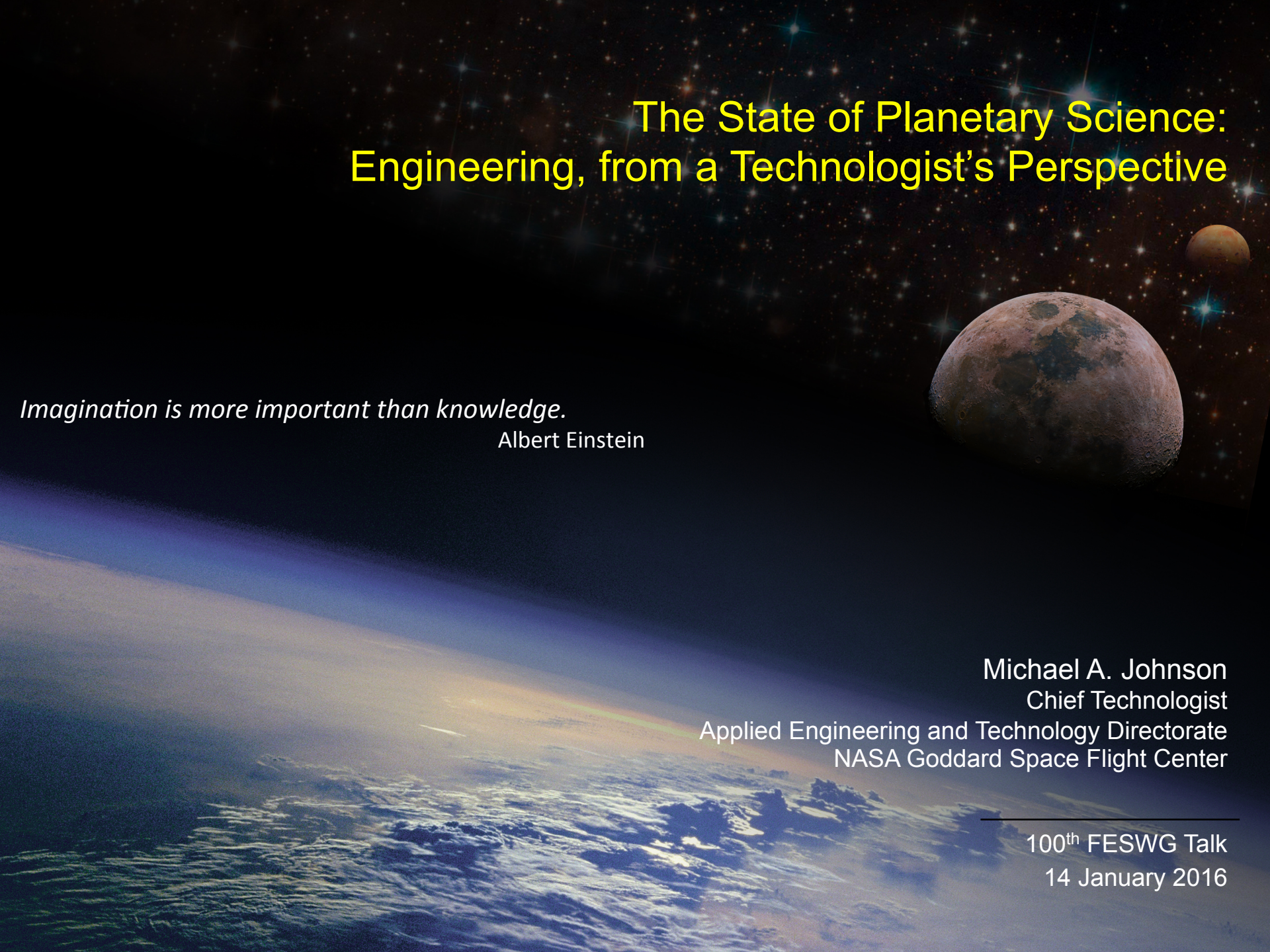
The State of Planetary Science: Engineering, from a Technologist's Perspective



Imagination is more important than knowledge.
Albert Einstein

Michael A. Johnson
Chief Technologist
Applied Engineering and Technology Directorate
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100th FESWG Talk
14 January 2016

The Applied Engineering and Technology Directorate

Craig Tooley
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Management

Felicia Jones
Director

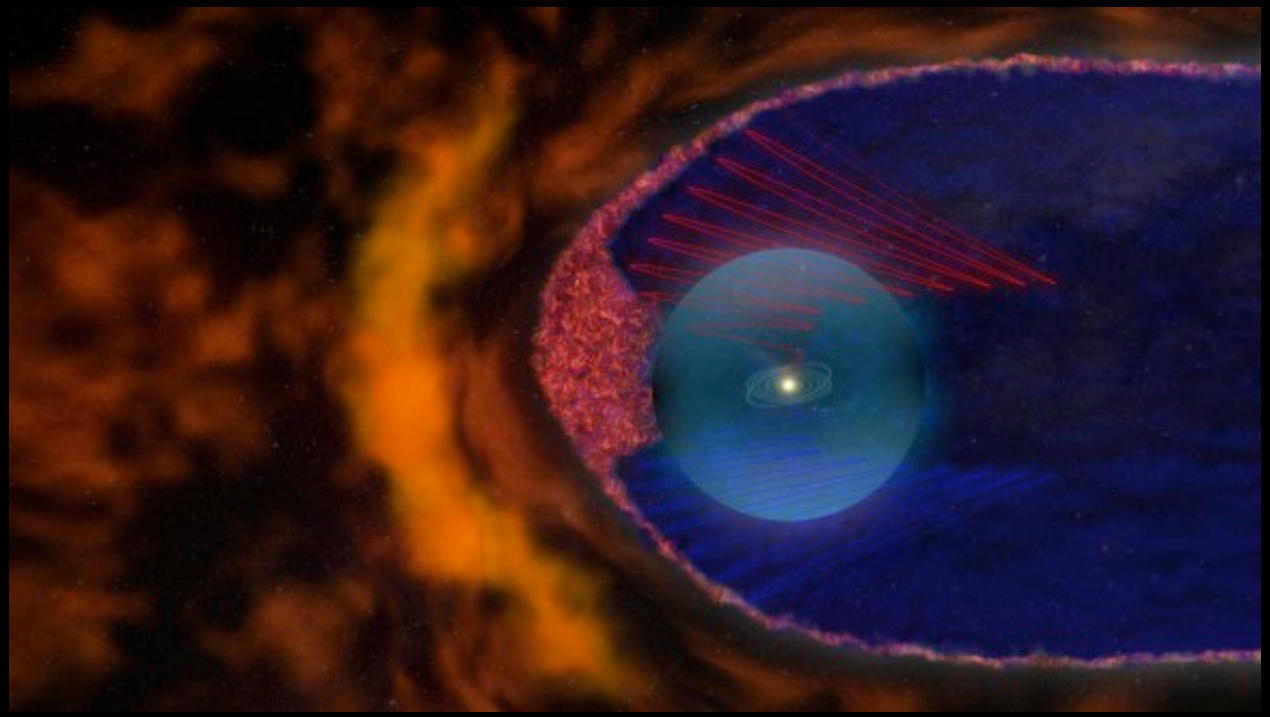
Karen Flynn
Deputy Director for
Business and
Planning

Our Solar System Is…

Replete with mysteries waiting to be solved and discovered via innovative mission and measurement approaches …

Our Solar System Is…

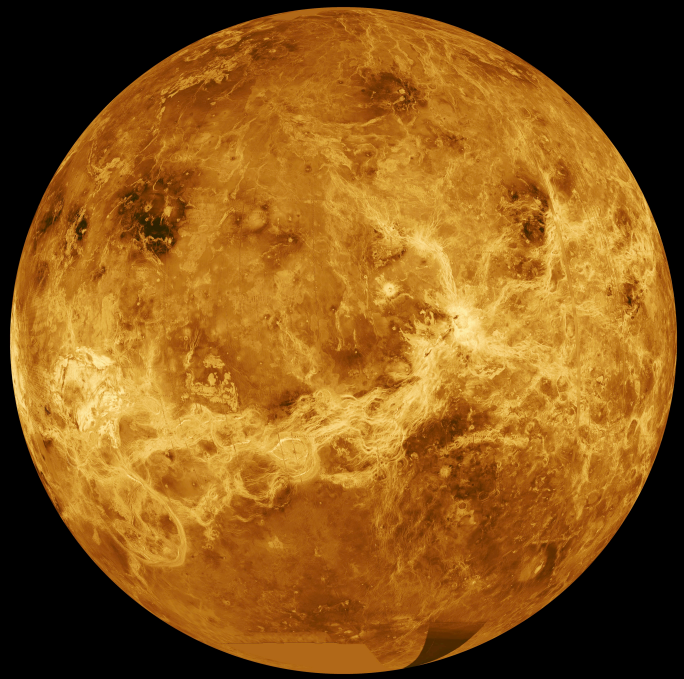
A vast frontier, with expansive and unfathomable distances separating environments of interest from our home planet…



Credit GSFC CI Lab

Our Solar System Is…

Intensely hostile to spaceflight systems,
providing more avenues to mission failure than to success…

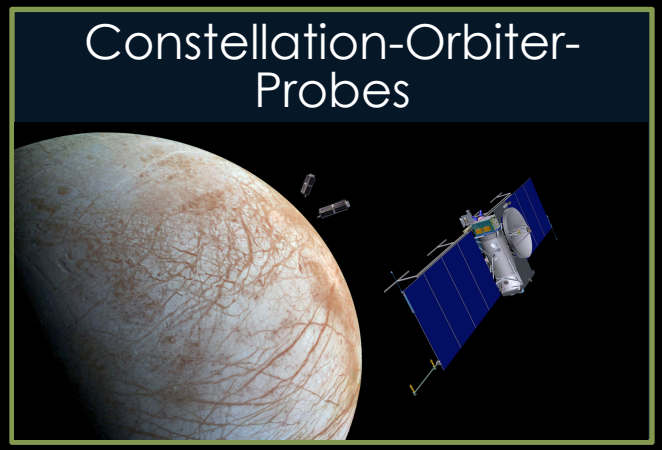


Our Solar System Is…

Challenging to space exploration budgets…

So What?

Novel Mission Approaches



Credit: JPL

Particles and Fields
– Distributed magnetic field measurements
– Radiation environment
– Plasma characterization

Reconnaissance
– Site reconnaissance
– Small object characterization

Atmospheric Science
– Distributed atmospheric measurements
– Atmospheric composition, search for volatiles

In-Situ Measurements
– Planetary surface composition
– Regolith mechanical properties
– Surface dust dynamics

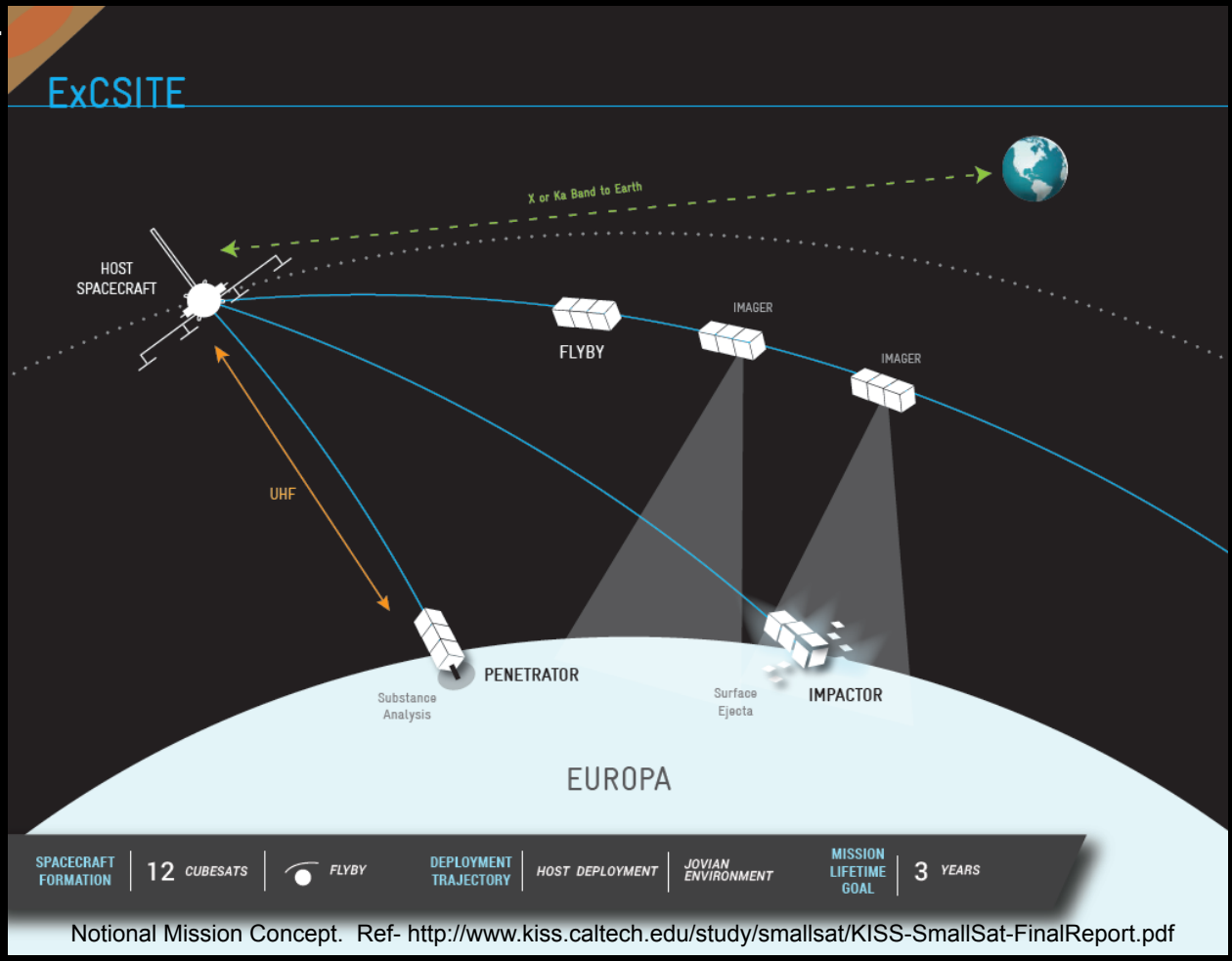
Novel Mission Approaches

ExCSITE: Europa Fly-By and Penetrator

The Explorer CubeSat for Student Involvement in Travels to Europa (ExCSITE) is meant as a smart instrument to be deployed from the Europa Clipper mission as it flies by Jupiter's ocean-moon Europa.

Measurement objectives include

- high-resolution imaging of the surface
- Magnetic/gravity mapping
- Characterization of dust ejecta from Europa

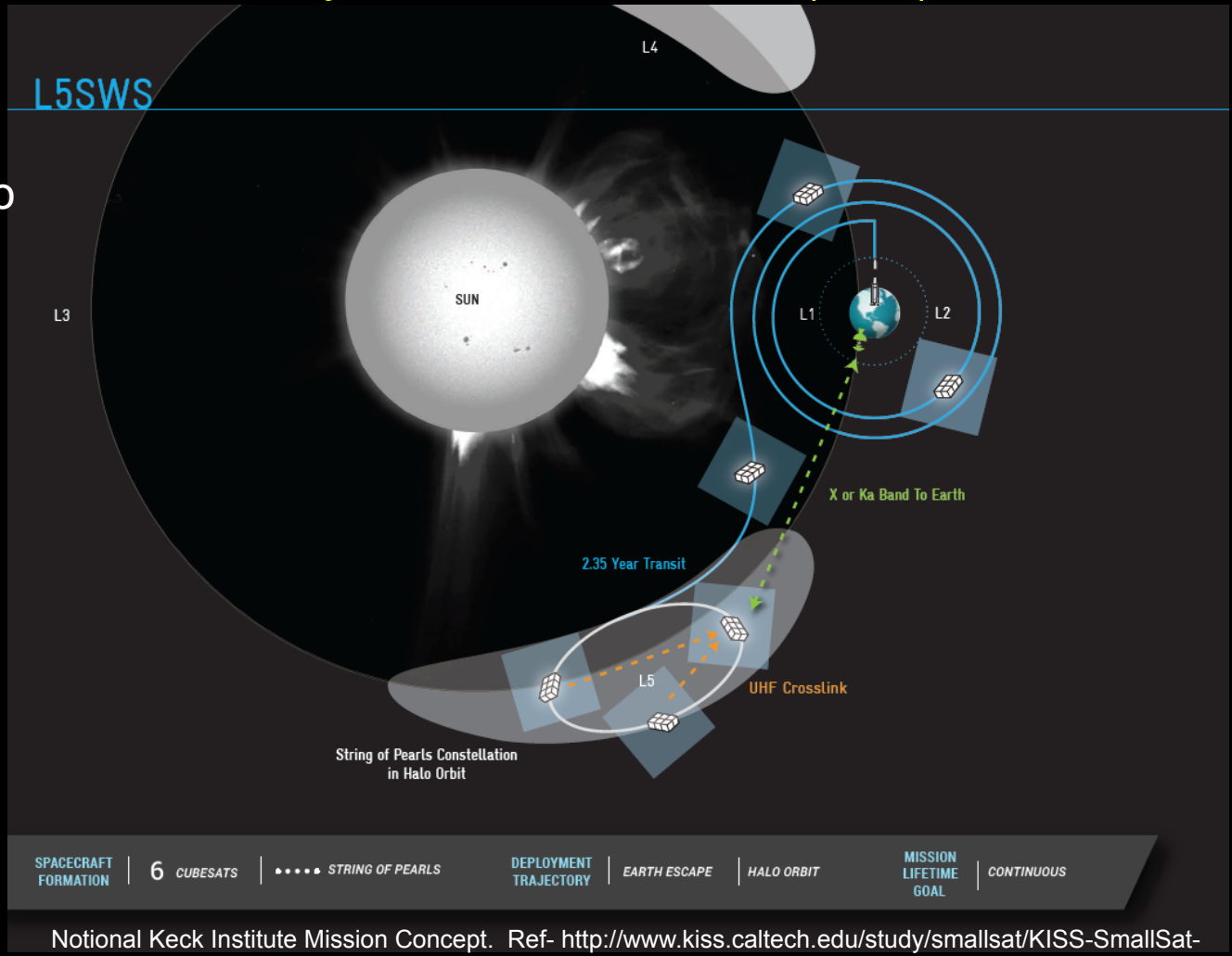


Notional Mission Concept. Ref- http://www.kiss.caltech.edu/study/smallsat/KISS-SmallSat-FinalReport.pdf

Novel Mission Approaches

Distributed Spacecraft Missions Beyond Low Earth Orbit (LEO)

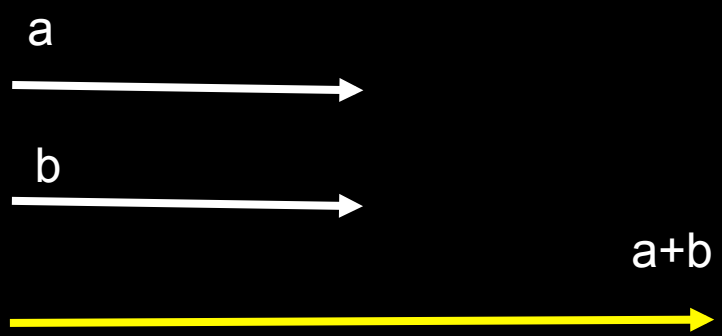
Ongoing development activities will mature Goddard capabilities to implement such novel mission architectures



Notional Keck Institute Mission Concept. Ref- http://www.kiss.caltech.edu/study/smallsat/KISS-SmallSat-FinalReport.pdf

The Necessary Ingredient:
Innovation

Innovation can be not just additive…



The Necessary Ingredient:
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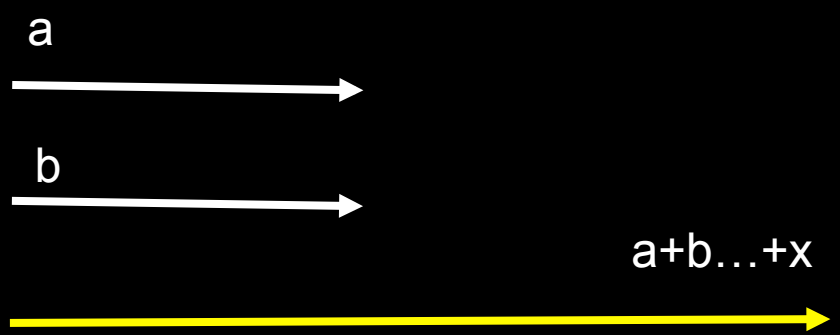
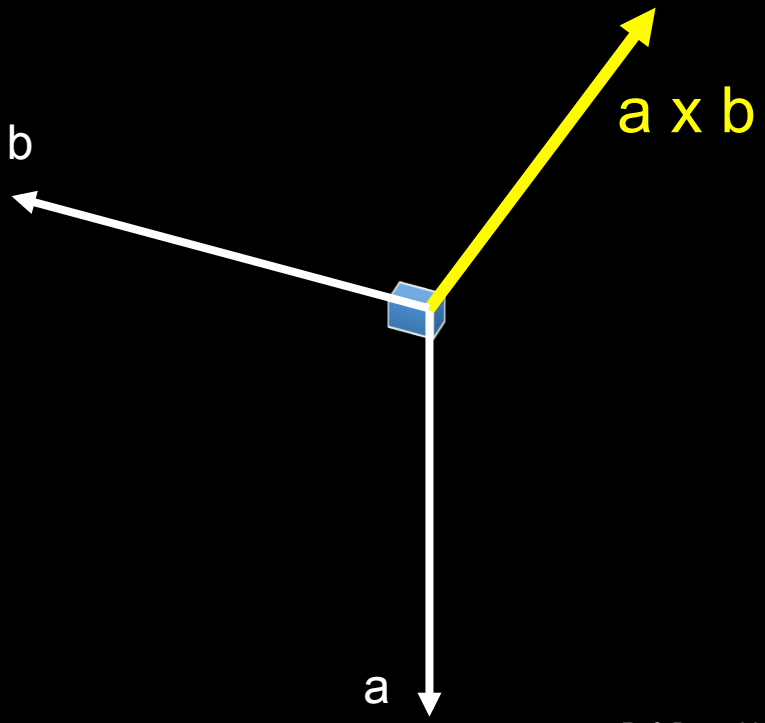


The Necessary Ingredient:
Innovation

Innovation can be not just additive, but multiplicative…

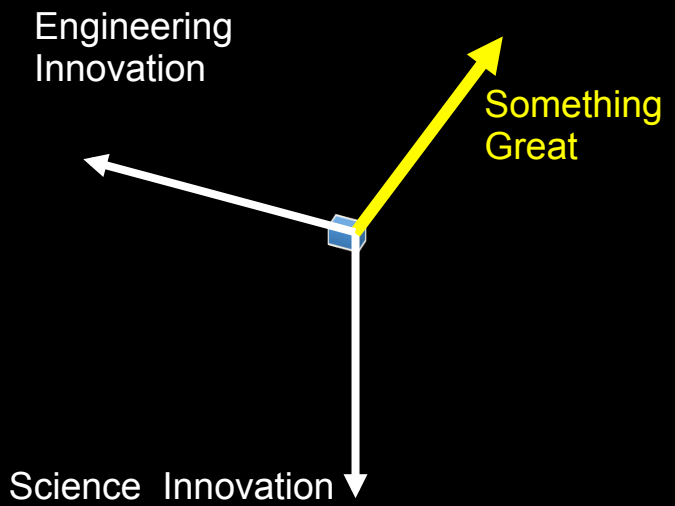


Ref: Bruce Vojak

The Necessary Ingredient:
Innovation

Innovation can be not just additive, but multiplicative…

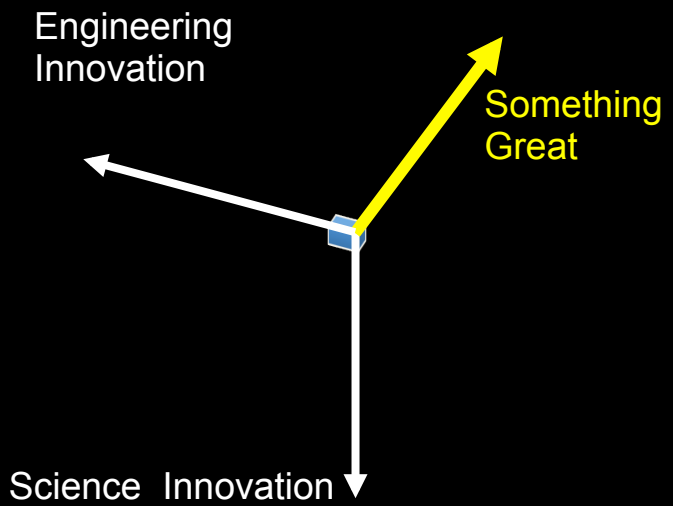
2015 Workshop
Scientists and engineers innovating collaboratively.



The Necessary Ingredient:
Innovation

Innovation can be not just additive, but multiplicative…

What's next?...



In Closing

Engineering and technology capabilities are advancing.
Innovation will enable new mission and measurement concepts.
We ~~can~~ should innovate together.
What's next?...


Thank you.
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